Original Article

Fixation for Fractures of Shaft of Humerus

# Outcome of External Fixation for Close & Acute Fractures of Shaft of Humerus in Adults

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## ABSTRACT

**Objective:** To assess the outcome of patients treated with external fixation for fractures of shaft of humerus.
**Study Design:** Descriptive / case series study
**Place and Duration of Study:** This study was conducted at the Department of Orthopaedic Surgery Quaid-e-Azam Medical College /B.V. Hospital Bahawalpur from May 2015 to October 2017**.**
**Materials and Methods:** The variable noted were age, sex, presenting complaint, duration of fracture, associated injuries and radiological finding before definitive management. The operative findings, site of fracture, postoperative course (pain, healing & mobility), Complications (swelling, neurovascular damage, infection, delayed and nonunion), Patients satisfaction, Clinical and radiological maturation of bone at fracture site were recorded.
**Results:** Total of 65 patients treated in study time. Fifty one were male and 14 were female. Mean age was 37 years (range 20 years to 40 years). The mean follow-up period was 16 weeks. (SD±4.7).There were 6 superficial infections treated successfully using oral antibiotics and no case was reported fornon-union.
**Conclusion:** External fixationis good method of treatment for humeral shaft fractures.This technique although is surgical demanding but leads to decrease soft tissue trauma.
**Key Words:** Fracture of the humeral shaft, External fixation,

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## INTRODUCTION

Fracture of shaft of Humerus is common fracture occurs 70,000 times in one year in North America. It is 3-5% of total body fractures.[1] By the new era in surgery, introducing the different methods of surgery and refining the surgical inventions, surgical treatment become dominant with passage of time. Operative treatment of diaphysial fractures of Humerus is required in associated neurovascular injury, open fractures[3,4], polytrauma, bilateral fractures & non-unions[3,4.] Otherwise all close & isolated fractures are conservatively managed because fractures of Humerus have tremendous capacity to heal[5]but metabolic & endocrine abnormalities can affect bone healing[6.] Although malunion is common in conservative healing of fracture of shaft of Humerus but functional outcome and range of motion of shoulder and elbow joint become so good due to proximal ball and socket joint and upper limb involvement, that all deformities, angulation and shortening of Humerus bone is ignored. There are different methods in operative treatment like, dynamic compression plating, locking compression plates[7,8,9], external fixation, and intramedullary (IM) stabilization. External Skeletal fixation has become popular over the past decade.[10, 11.]

In 1907 A. Lambotte described treatment of humeral shaft fracture with a unilateral external fixator[12] Although external fixation method is commonly used in open shaft of humerus fracture or in skin burn with fractures where internal fixation by surgical treatment is not possible due to soft tissue defect. External fixation is also indicated in comminuted fractures or complex fractures of shaft of humerus where good reduction and maintenance of reduction by other surgical techniques is a challenging problem but when external fixation technique is used in simple close transfer or oblique fractures of shafts of humerus, very good results are achieved. In this minimum invasive technique where advantages of close reduction like preserving hematoma and minimum soft tissue insult is observed, at the same time advantages of the open surgery like proper reduction and strong stabilization of fracture with start of early range of motion of shoulder and elbow joints are achieved.

## MATERIALS AND METHODS

A descriptive case series study was conducted in our institute, between May 2015 and October 2017, were studied. Duration of follow-up was from 4 months to 6 months. Inclusion criteria was close transverse and oblique fracture of humerus, fracture proximal, middle and distal shaft of humerus and acute fracture of humerus presented within 48 hours. Exclusion criteria

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was open fractures, comminuted fracture, intra-articular fracture, fracture of extreme ages and pathological fracture of shaft of humerus.

All cases, received in casualty, was examined and assessed for associated injuries. Investigations like urine C/E, blood C/E , serum sugar , viral markers, blood grouping, cross matching and serum renal function test, ECG/Echo (if needed) were also done. Standard AP and Lateral radiograph of humerus were taken.

Data was collected on a predesigned performa. The variable noted were age, sex, presenting complaint, duration of fracture, associated injuries and radiological finding before definitive management. The operative findings, site of fracture, postoperative course (pain, healing & mobility), Complications (swelling, neurovascular damage, infection, delayed and nonunion), Patients satisfaction, Clinical and radiological maturation of bone at fracture site were recorded.

General anesthesia was given to all patients. After getting the reduction of fracture site by close manipulation under image intensifier, 3 Shanz pins were passed atanterolateral aspect of the proximal part of fractured humerus (along anterolateral margin of deltoid muscle) & 3 Shanz pins (sometimes 2Shanz pins) were passed in the distal segment on lateral side of humerus, proximal to olecranon fossa. The proximal & distal Shanz pins were connected with the clamps of external fixator & horizontal connecting bars. The fracture reduction was checked in Image Intensifier. Connecting rods along with proximal& distal Shanz pins were tightened with the clamps. All patientswere discharged after assessing the fracture reduction on radiograph within 24 hours. Subsequently radiographs were taken after 2nd, 4th, 8th, 12th, 16th and 20th weeks to see the callus formation at fracture site. Fracture union was assessed radiographically by seeing the callus formation and clinically by observing the abnormal movement of the fracture site. The whole follow up was taken by the researcher.

For this best site for proximal Shanz pins insertion is distal to insertion of deltoid muscle and anterolateral margin of humerus. Best distal Shanz pin side is just above the olecranon fossa and in radial condyle in olecranon in fracture shaft of humerus. Minimum 3 cm distance from the fracture line is recommended during insertion of Shanz pin to avoid the access of fracture line with pin track.

Post operatively shoulder & elbow range of motion was started when pain subsided.However, all patients received cefuroxime 1.5g at induction followed by 750mg at 8 hours and 16 hours postoperatively. Physiotherapy was started at first day postoperatively. In follow-up evidence of union and range of motion of both shoulders and elbow joint were assessed. Radiologically bridging of callus at fracture site was seen and clinically pain free movement at fracture site was observed.

**Operative Definition:**

| Grading | Fracture Healing in 3 months |
|---|---|
| Excellent | Good callus with good clinical healing and complete range of motion |
| Good | Callus formation with good clinical healing with acceptable range of motion |
| Fair | Poor callus with acceptable clinical healing & limited Range of motion |
| Poor | Non-union |

# RESULTS

Sixty five patients of fracture shaft of humerus were treated by external fixation. Mean age of patients was 37 years, range 20 years to 40 years. All fractures were close fractures. There was no intra-articular extension. Two cases were associated with head injury and 7 cases admitted with poly trauma, (associated fracture of radius and ulna of same side) External fixator was not removed till complete healing of fracture site. Forty nine cases (75.3%) showed union between 9 and 12 weeks, while 16 cases (24.7 %) showed union between 13 and 16 weeks. Average period of union was 14.63 weeks. Fracture site of all cases with external fixation was healed. Delayed union and nonunion was not reported and Bone grafting was not required in any case. Postoperative nerve damage was not seen.

**Table No.I: Details of operative finding and healing**

| **Injury-surgery interval** | | **Operative time** | | **Period of healing in weeks** | | | | **Range of motion** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| < 1 week | >1 week | < 60 min | >60 min | Radiological | | Clinical | | Comp-lete | Good | Fair | Poor |
| 25 | 40 | 54 | 11 | 9-12 | 13-16 | 9-12 | 13-16 | 50 | 12 | 03 | 0 |
| 38% | 62% | 83% | 17% | 49 | 16 | 55 | 10 | 77% | 18% | 5% | 0% |

**Note: Range of Motion**

Shoulder joint (Abduction, adduction, flexion, extension, internal and external rotation).

Elbow joint (Flexion and Extension)

Complete: 90-100 % (Shoulder and Elbow Joint) Good: 70-90 % Fair: 50-70 % Poor: less than 50 %

In 7 cases, restricted shoulder movements especially abduction of shoulder joint were found. In these cases proximal Shanz pins were inserted more proximally (Subcapital or Subacromial) in proximal and middle humeral shaft fracture. All movements were restored after removing the Shanz pin after complete healing of bone in 14 weeks. In 4 cases discharge from the proximal pin-tracks was seen and skin was released at site of pins in 3 cases. There was a single complication in the form of superficial infection secondary to skin necrosis treated with local debridement and antibiotics. Radiologically deformity, of shaft of humerus was found after complete healing of fracture. But overall clinical result were very satisfactory due to good functional outcome of upper limb. Patients were very much satisfied. The average operative time was 45 minutes. Average period for hospital stay was 12 days.
Sixty cases (92.3%) had excellent outcome while 5 cases (7.7%) had excellent to good outcome regarding union and joint movement.

# DISCUSSION

External fixation is also good option in the treatment of very distal humerus shaft fracture. It is minimum invasive technique which gets all benefits of close reduction, early range of motion and low stiffness of shoulder joint. External fixation is technically demanding in fracture shaft of humerus due to different configuration and site of fracture. Workers have reported but if the fracture is in proximal Humerus it become difficult to insert Shanz pins proximal to fracture site.[15] So most proximal pin at subcapital or subacromian region, grossly restricts the shoulder movements specially the abduction of shoulder joint. If fracture line is at mid shaft of humerus level, still the insertion of proximal Shanz pins are technically demanding to safe the maximum muscle mass and neurovascular structure. If the fracture line is at distal level of shaft of humerus the best site for inserting the Shanz pins is anterolateral of Humerus, distal to insertion of Deltoid muscle to get the maximum function of deltoid muscle and early range of motion of shoulder joint. Distal Shanz pins site in distal Humerus fracture is through the Radial condole and Olecranon of Humerus and proximal to Olecranon Fossa. In this technique pilot k wire is applied first, before inserting the Shanz pins in radial condyle and trochlea and above the olecranon fossa, to achieve good control of distal segment. Shanz pin position at humerus is very important. If proximal and distal Shanz pin apply at site where minimal bones and muscles movement occurs, the good and early range of motion of both shoulder and elbow joint, minimum joint stiffness, minimum pain, minimum pin tract infection and early bone healing results. If the Shanz pins passes through soft tissues enveloping the bone, sliding of muscles upon bone reduces which on one side leads to restricted shoulder and elbow joint movement and on other side it also increases the frequency of pin tract infection[16, 17]. This infection loses the pin and risk of ring osteitis increases. To avoid this, any loose pin is removed or is replaced.[18] It is generally accepted that pin tract infection becomes low when all the principals of external fixation follows. Although sometimes compromise position of Shanz pins leads to restricted joint movement but after removing the Shanz pins aggressive physiotherapy starts of both shoulder and elbow joint. In this way functional outcome of both shoulder and elbow joints become good after few weeks after removing the external fixator.[15]
In our study infection and healing was quite acceptable as compared to other studies.[15, 19]

# CONCLUSION

External fixation is good method of treatment for humeral shaft fractures. This technique although is surgical demanding but leads to decrease soft tissue trauma.

**Author's Contribution:**

| | |
|---|---|
| Concept & Design of Study: | Shujaat Hussain |
| Drafting: | Tayyab Mahmood |
| Data Analysis: | Tayyab Mahmood, Muhammad Iqbal |
| Revisiting Critically: | Shujaat Hussain, Muhammad Iqbal |
| Final Approval of version: | Shujaat Hussain |

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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